

LECTURE,

INTRODUCTORY TO THE

FIRST COURSE OF LECTURES ON POPULAR PHYSIOLOGY,

INSTITUTED BY THE

AMERICAN PHYSIOLOGICAL SOCIETY,

October 10, 1837.

BY BENJAMIN HASKELL, M. D.

PUBLISHED BY REQUEST.

Boston:

OFFICE OF THE GRAHAM JOURNAL.

No. 9, Washington Street,

1838.

PREFACE.

The delivery of the following Lecture was preceded by the announcement of a theory which professed to explain what has been hitherto considered inexplicable among the operations of nature, viz. the appearances which are exhibited in all matter subjected to the agency of the vital principle. As those who heard it may feel an interest to know whether the time that has elapsed has confirmed or staggered me in the opinions then advanced, I take this opportunity to renew the statement I then made, under a new and more extended form. The proposition, as now matured by observation and reflection, stands thus. That the developement and anatomical structure of every organized being, takes place in accordance with the mechanical laws of a subtle, elastic fluid, like electricity. That the experiments of physiology, and the phenomena of disease, are reconcilable to the same laws, and only to these laws. The existence of such a fluid, and its activity in the processes of life, has been more than suspected by physiologists; but the true series of facts, destined by the author of nature to demonstrate it, has not heretofore arrested the attention of mankind. Yet that these facts are abundant and to the purpose, will be acknowledged by any person who will take the trouble to examine them with candor and deliberation. In the Medical Journal several papers have appeared, in which I have traced analogies enough between the laws in question and the structure of some of the most important bodily organs, to establish the point beyond dispute. And I would add, that wherever regularity is observable, in the form or structure of bodies or bodily organs, in the performance of the healthy or diseased functions, in inflammation and fever, that regularity may be deduced from the same laws. This position it would afford me pleasure to illustrate from specimens of natural history in my possession, to any person who may feel sufficient interest in the subject to call on me for the purpose.

B. H.

LECTURE.

The science of physiology being defined the science of life, admits of some variety of construction. As commonly applied to the investigation of the functions carried on in the human body, during the successive periods of its developement and decay, from infancy to old age, it forms the subject matter of inquiry to societies constituted like yours.

There are, however, a series of functions, which are peculiar to man, among animated beings—a sort of life which is not shared equally by each individual, but belongs to the species, as a common stock—a principle of vitality, which is the germ of human power and improvement, whose first manifestation is coeval with the first step man takes from the state of nature, towards civilization and refinement, and is active in every stage of his progress—one, which has its fevers and convulsions, its periods of depression and re-action, corresponding with the changes and revolutions that pass over the face of human affairs, and which will not cease to display its workings until the final extinction of the race.

It is this species of physiology, which I shall avail myself of the latitude afforded by the present occasion, and the popular nature of this association, to make the subject of this lecture. And perhaps the best method I can take to illustrate it will be, to present man in the opposite states of complete barbarism, and the most highly improved condition to which he has as yet attained, and to glance at the chief characteristics he exhibits in each successively. To view him in his littleness—to view him in his greatness—to survey the relations he sustains to himself and to things around him—the scope

and extent of his faculties—his use and abuse of them. Finally, by contrasting his infant weakness with the growth and evolution of his inherent capacities—to form an estimate of his rank in the scale of the universe, and from the light thus afforded, to anticipate his future destiny.

The contemplation of Man, in his primeval state, or that of complete barbarism, leaves us at a loss to discover by what principle of power or spring of action, he has been able to attain to that lofty elevation where he exhibits himself at the present age, in the most highly civilized communities. Whether we regard his power over the substances of nature, the elements, and other animals, or consider him in his physical endowments, or even his intellectual manifestations, his peculiar boast—the marks of his superiority are hid from our view. The further we trace him back from the confines of civilization, the more diminutive in the scale of being does he appear. He dwindles and dwindles in the field of vision, until we recognise comparatively nothing of the features and attributes we are accustomed to consider as exclusively his own. His erect attitude, his form, the lineaments of his countenance, are perhaps all that are common characteristics between the two states. The lion and the leopard excel him in strength and agility—the reptile in cunning. The eagle has a keener sense of vision—the dog and vulture of smell. In all his functions and instincts he has his superior and instructor in some one or more of the inferior animals. The bee, the ant and the beaver, may teach him the virtues of frugality and industry, the first principles of architecture, and what is more wondrous still, the advantages of social and political combination. The charms of domestic life, as well as the harmony of music, and others of the imitative arts, are illustrated by the feathered warblers, long before he begins to practice the lesson they teach him. The spider learns him to weave—the silk-worm to spin. Providence, as if foreseeing the danger to which they would be exposed, has intrusted to the keeping of these little animals, instead of him, the rudiments of knowledge and the first principles of art.

But if by regarding man in this light, we find inferiority to other animals, where he now exhibits superiority,

it is not owing to his wants being less than theirs, or the means of satisfying them less abundant in nature, than they now are. On the contrary, he is acknowledged to be the most helpless and destitute of all animals—the least protected by any external covering from the vicissitudes of temperature. His hands are not formed for digging, that he may burrow in the earth, nor his feet for climbing. His teeth were never intended, like those of many other animals, to supply the place of cutting instruments. He is, moreover, more restricted in his movements than most animals. Confined to the surface of the earth, without armor for defence or arms to attack—he can neither like the bird, nor like the amphibia, escape into one element from the foes that harrass and devour him in another. So far as we can judge from external appearances, we have every reason to infer, were he doomed to remain always a creature of mere instinct, without advancing a step beyond the point where the work of creation leaves him, his race would be the first to become extinct. Even that intuitive discernment, which to other animals is a sure and unerring guide in the choice of food, fails him when he would make use of it to discriminate what is capable of assimilation to his bodily elements, from what is poisonous or foreign from his nature.

But the most interesting point of view in which we can contemplate man in a barbarous state, to contrast him with the characteristics he presents when civilized, is that which regards the impressions made upon him by external objects. In total ignorance of the laws of nature, of the processes of art, of the inward workings of his own mind,—how limited and partial must be his views—how narrow his conceptions—how few his pleasures, whether sensual, intellectual, or moral.

The heavens are above him, with all its infinitude of glorious constellations. But what idea has he of the revolutions of the planets in their orbits, of comets, and of the celestial mechanics? On what responsive chord of intellect, or of moral feeling, do the harmonious movements of the universe vibrate, eliciting an echo, while it charms him with the music of the spheres?

The earth, too, is spread out before him with all its gorgeous array of beauty and utility, in every thing that moves or waves in the breeze.

Nature presents to his five senses the same variety of objects calculated to excite thought and emotion then, as now. But uncultivated and rude as he is, the reaction of his mind upon them stops at mere sensation. There are forms and colors to please the eye, melody for the ear, odors for the sense of smell, and sweets for that of taste. But the impressions they make on his organs are feeble and transient, and confined to them alone. The varied trains of reflection which they are calculated to call up in the mind, as the media by which to ascertain the properties and qualities of bodies—the thousand associations which may be excited by blending the varieties of light and shade, and of sounds in harmonious unison, are unknown to him. He contributes nothing of his own to increase the gratification which they are calculated to afford. He reasons not from cause to effect. He does not multiply by imitation, the sources and means of happiness. He perceives not the harmony between structure and function, between means and end, and the nice adaptation of all things around him to each other, and especially to his own wants. He reads not the volume of natural religion which is open before him—so richly eloquent with the manifestations of a designing Omnipotence. And if perchance he eventually arrives at some conception of the Deity, he recognises him not in the wisdom and benevolence displayed in his works, but only when he exhibits his sterner attributes. He sees him not, when he

“ Warms in the sun, refreshes in the breeze,
Glows in the stars, and blossoms in trees,”

but when he glasses himself in the tempest, glares in the lightning, speaks in the thunder, or breathes in the volcano. Fear and terror can alone awake to reflection his grosser sensibility, and hence it is not to be wondered at, that the ideas of God among the most rude and barbarous tribes, coming through such a medium, represent him as a God of cruelty and vengeance, instead of mercy and peace.

His body is warmed by the same sun—animated by the vital influence of the same atmosphere—cooled and refreshed from the same chrystal founts. And all his

knowledge of the nature and properties of heat—of the constituents and mechanical properties of air and water, begin and end in feeling and allaying the single sensations to which they bear relation, without even so much as possessing words to describe them.

There are essentially the same mineral treasures beneath and upon the surface of the earth, as now—the same animal and vegetable forms—the same vital and chemical processes going on within and around him. The depths of ocean abound with its leviathans, its pearls, and its groves of coral. But of what avail are all these to the savage? He knows nothing of the uses of the domestic animals—nothing of the medicinal properties of the vegetable kingdom—of the sculptured and architectural forms that may be wrought from the Parian marble, or the value of the gold of Ophir—of the diamond of Brazil and Peru, and of the iron of Russia and Sweden.

Let us now change the scene, and take a brief survey of man in the new medium in which modern civilisation exhibits him. We now find that that being which was originally the most helpless and destitute of all animals, to all appearance, has either subjected to his use or driven out from his presence the whole of the brute creation. The horse and the ox, the camel and the elephant, he loads with his burthens. The lion and the tiger he follows into their dens and fastnesses, and leads them forth in chains and cages to disport himself with their fierceness and cruelty. He whose movements were primarily limited to a small spot of ground, has spread himself over the whole earth, and inhabits the torrid as well as the frigid zone. Nay more, he courses with the eagle, on silken pinions, in his ærial voyage, or makes his bed on the foaming billow, and pursues leviathan himself through every region of his native element. The elements and the laws of nature are appropriated to his purposes. He directs the course of the lightning, once the object of his superstitious dread. The rushing torrent, the huge cataract are made to propel his machinery and minister to his necessities. He changes even the order of the seasons, and reverses climates. In winter he sows, and gathers the fruits of summer. In the northern clime he regales himself with the odors of the southern blossoms; in the southern, he cools his fevered lip with

the melting ice of the north. He approximates the ends of the earth, and places all nature under contribution to supply his real or fancied wants. He mingles at his morning and evening meals, in the same cup, the products of two hemispheres. He creates commerce, and commerce clothes him with the manufactures of the most distant countries. It covers his person with the silk of China, the wool of Smyrna, the furs of Astoria, and adorns it with the ruby and the emerald.

Borrowing from the bee and the ant the principles of architecture and the mechanic arts, he has proceeded step by step, from little to great, until the bee-hive and the ant-hill have expanded into the spacious city, with its marble palaces, its temples with their lofty domes and columns. Profiting by their teachings on political economy, he has magnified his power by political combination, and formed himself into states, republics, kingdoms, empires, to concentrate his scattered energies, and direct them towards any given point.

Taking a hint from the pairing of the feathered tribes, he has discovered the secret of domestic happiness, in the bonds of wedlock, and has increased and multiplied it by a thousand endearing ties and reciprocal obligations. Receiving from the nightingale and the lark, time, tune, and melody of sound, he has changed the chords of vibration and transposed the notes, until their simple songs are lost in the infinity and complexity of the oft resounding vocal choir and instrumental band. Whatever of science or of art nature has deposited among the inferior animals, and displays to him by the workings of instinct, he appropriates to himself, cultivates and reproduces in forms ever varying and new.

The gifts of nature to him personally are augmented in a wonderful degree, and the loss of them by disease or accident supplied by his ingenuity. If one of his senses, by disease or accident is wanting, he makes up for it by educating and adding to the function of another. To the blind he causes the touch to perform the office of vision—to the deaf, the eye he makes to hear, and for the dumb, the hand performs the motions of the tongue.

Again. He whose natural sphere of vision was limited in its power of distinguishing form and color to a circuit of a few miles, has given himself an artificial eye, which

extends it so wide that miles are too short to afford a means of measurement of it, and another which enables him to examine objects so minute that imagination fails in endeavoring to form a conception of the space they occupy.

By means of these two instruments, (the telescope, and microscope,) and other artificial aids, he explores the most remote and hidden recesses of nature, and brings forth from her rich store-houses the vast and constantly accumulating treasures with which modern science abounds. With the one, he has transported himself into the regions of space, and not only has he given laws to the motions of the heavenly bodies, numbered and classified them, and assigned to each its place in the universe, with mathematical accuracy, but even seeks to penetrate the obscurity that envelopes their origin and mode of formation, by calling into existence an universal fluid or plastic ether, to mould those vast orbs and revolve them around each other. With the other, he contracts his dimensions and becomes the citizen and explorer of worlds as far beneath the ken of ordinary vision. Occupying thus the middle ground between the two extremes of magnitude and diminutiveness, of distance and proximity, he alternates the survey of the motions and surfaces of globes, with the survey of the motions and surfaces of globules; the study of spheroids of thousands of miles in diameter, with the study of spheroids of thousandths of an inch.

The physiological history of the earth is laid open to his investigations. He reads from the volume of nature the story of its birth in chaos, studies its growth and successive developements, as it slowly progressed in its capabilities of supporting animal and vegetable life. He is able to recognize a period of childhood, of youth, and of manhood, in our great and common mother, illustrated by the records of geology, such as he experiences in his own person. A period in which it could support on its surface but the reed and the fern, the simplest of the vegetables, and the lowest species of animals. Another, in which the more complex, but still imperfect structures of both kingdoms, may derive subsistence from its soil. A third, in which himself, the most complete of animated beings, is enabled to live and manifest his high func-

tions. Finally, he compares what he observes on his native planet, of its form, its structure, its motions, its changes,—with what he sees, through the telescope, taking place in regard to other planets, and perceives that they are all of the same brotherhood. The same matter brought together in similar forms, regulated by the same laws, and operated upon by the same agencies.

Man, however, does not confine his attention to the masses of matter. From the examination of the earth as a whole, he turns to the examination of its constituent parts. He enters the laboratory, and with the crucible subjects the compounds formed by nature to agencies which resolves them into their primitive elements; recombines them at will, and produces thousands of new and interesting bodies which are capable of subserving his interest, adding to his resources, and increasing his happiness. He analyses the atoms of matter, and ascertains the proportions in which they unite, and the laws that govern their union. He searches also into the nature of the agencies that effect the various changes going on in the universe. Light, heat, electricity and magnetism become the creatures of his will—with all their power, they come and go at his bidding. He first examines into their qualifications, and then enlists them as his servants. Through their instrumentality he metamorphoses the elements—turning earth into air, air into water, fluids into solids, and solids into gasses, evolving new agents, and new powers, which he uses to propel him and his accumulating treasures, against wind and tide, up the swiftest currents, and as far beyond the fixed confines of his native planet, as he is permitted to soar and yet breathe the breath of life.

By means of them he divides the indivisible; sets on fire the incombustible; unites the acid and the alkali, and in their union destroys their personal identity. The lustre of the diamond he converts into the blackness and deformity of charcoal; and imitates the beauty of the sapphire and the topaz.

But I need not enlarge on this point. Of man's power over the processes going on in nature, and of his ability to imitate them, the people of this city have recently had an exhibition,* alike honorable and gratifying to their pride

* The Mechanic's Fair, in Quincy and Faneuil Halls.

as men, and as inhabitants of this, the most highly favored portion of the globe. The whole forming a scene worthy of the time and place—a scene fit to be associated with the venerated relics of a revolution, which gave to civilisation its greatest impulse forward, and one which the fathers of that revolution might contemplate with a proud satisfaction, as the richest offering of the first fruits of the tree that was planted and watered with their blood. Let any one who would form an idea of the changes wrought by, and advantages of civilization, compare the impressions he must have experienced in those halls, with those he would receive, on witnessing all that might be collected of what is useful or ornamental, among a tribe of Caffrees or Hottentots. In the one, where every sense was addressed, with whatever is capable of charming or of pleasing in the imitative arts; in the other, where nearly every branch of science was represented—represented, too, in its splendid re-action on the condition of man—enlarging his power and multiplying his resources and means of happiness. Or, what is a still more ample theme for self-congratulation, let him contrast the monuments of wealth, industry and patriotism, the noble charities, and the institutions of learning and moral improvement that cover and adorn the soil, together with the life diverging into its thousand trains of pursuit, within the compass of a few miles immediately around us,—with the sear and fallow leaf, the wigwam, the hunter and his game, that covered it two hundred years ago.

There is no modification or affection of matter that escapes the penetrating inquiry of man. To give a list of the different branches of his investigations, would require a volume instead of a single lecture. His mechanical ingenuity enables him to divide it into portions almost inconceivably small, and supplies him with instruments to weigh and measure it with an accuracy as wonderful. And where division is no longer allowable by mechanical means, he still, in the processes of chemistry, resolves it farther, and invents a method of calculation, by which he is able to compare the properties and estimate the relations of its ultimate atoms.

There is nothing in the universe so irregular and confused, but that he is able to extricate order and regularity out of the seeming confusion. He ascertains and fixes

the laws of the ever-changing winds, of the tides, of the meteors that once appalled him as they moved through the air, classifies the soils beneath his feet, as well as the clouds that sweep over his head, and reasons with the falling dews and the hoar-frost.

Such is a faint idea of the relation which man sustains to the inorganic world. A field of observation no less extensive and interesting is opened before him in the animated part of creation. In this field he has labored with a zeal and a success that has enabled him to trace the principle of life, from its first appearance in the moss, fern and mushroom, when it scarcely can be distinguished from its kindred principle, that works in the crystal, disposing its particles in regular and definite forms—to trace it through its millions of evolutions—now, portraying itself on the painted petals of the rose and the lily—now, imaging itself in the lofty figure and wide-spread foliage of the branching oak—now, almost losing itself again, in the sponge and the polypus, as it passes from the vegetable to the animal world; thence, as it creeps, swims, flies, walks, in all, through more than two hundred thousand species of organized beings, whose structures, functions and instincts he has described—until he arrives at himself, and recognises in his own person the head of creation—the climax of infinite wisdom; through all the changes of form, until he stops at his own, the most perfect; through all the varieties of structure, until he discovers his own, the most complex, and yet complete; through all the modifications of motion, until he reaches his own, the most diversified and free; through all the manifestations of instinct, until he recognises his own intelligence, supreme and wonder-working.

Hitherto, we have considered man as he is affected by, and affects things around him. But we have now to consider him in a new and far more interesting point of view—the relation he sustains to himself. The study of the works of nature is, indeed, but the preliminary to the study of himself. The world without is the avenue to the world within. He now finds that he has the power to turn his thoughts home to his own tabernacle of flesh, and, from the accumulated store of his own knowledge, to illustrate how fearfully and wonderfully he is made. So fruitful is this new field of research, and so success-

ful has he been in cultivating it, that, while there is scarcely a member or organ of his body, on which he has not written volumes, there is scarcely a principle which he has evolved in his investigations of the chemical or mechanical properties of substances, that he does not again exhibit and illustrate in his material frame. The mechanical powers—the three levers and the pulley—he finds in constant operation in his muscular movements. He preserves his equilibrium by antagonizing one set of muscles with another,—discloses another system of hydraulics in the circulation of the blood; and even succeeds in solving the problem of perpetual motion. He reconsiders the laws of pneumatics, atmospheric pressure, and the chemical properties of air, to explain the phenomena of respiration. For the elucidation of the motions of his body, he founds a system of animal mechanics; for the elucidation of its internal functions—as digestion, respiration, secretion, and nutrition—a system of vital chemistry. He finds, moreover, within himself, an apparatus adapted to the laws of light—another, and yet another adapted to the laws of sound—a number adapted to the laws of electricity. He perceives, also, that he is thrown into a variety of perturbations by the action of the sensible qualities of bodies, both animate and inanimate, around him. These he distinguishes from each other, as they are agreeable or painful—as they excite or derange his vital actions—as naturals, or non-naturals—as poisons or remedial agents. All the changes wrought in his system by these influences become the subject matter of his investigations; and the manifold and fickle phenomena of disease are numbered, arranged, and counteracted by his discernment and discrimination, and by his skill in the employment of one class of these agents to modify the effects of another. So closely has he questioned nature, that he becomes her tutor and instructor, as well as interpreter. It is thus he may be said to become an actor in the province of life itself; and to exert over the mysterious processes of vital, a power similar to that he exercises over inorganic chemistry—a power too, which he extends to the animals and vegetables for which he has use, improving the good qualities of the first by crossing, and by transplanting and engrafting—converting the poisonous root of the latter into the esculent—the single

flower into a double one—the bitter fruit into the sweet; so that it would hardly be impious to say of him, at the present day—he gathers grapes of thorns, and figs of thistles.

Let him now cease to direct his attention towards external objects, or towards the motions of his material frame. Let him put a stop to all sensation, external and internal. Let him cease to feel the impressions of light, of sound, of odors, of taste, and of touch. Let him no longer experience the pains or the pleasures of sense—the excitements of health, or the irritations of disease.

Is there any thing about which he may still be conversant? or is he steeped in dumb forgetfulness? Is there any thing about which he may still employ his thoughts? Neither mineral, nor vegetable—neither plant, nor animal—neither earth, air, fire, nor water—neither light, heat, nor electricity—neither sun, star, nor planet—comet nor meteor—neither mechanics, animal, terrestrial, nor celestial—neither chemistry, organic or inorganic, awakes a sensation or moves a muscle—silent and motionless, as a marble statue, is he still active? and if so, about what? On what does his activity expend itself?

To these interrogatories I answer, that not only is he active, but that he is engaged on a more subtle and ennobling inquiry, than has as yet engrossed his attention. The very instrument by which he has been enabled to accomplish so much—that mysterious principle which has borne him through the universe of things, and exhibited to him its complicated machinery, in full and harmonious action, becomes in turn the subject of its own scrutinizing investigation. The manifestations of mind succeed the manifestations of matter and its affections, and form the objects about which the mind itself is conversant. How wonderful is this? That which attends, attends to itself attending—that which thinks, perceives that it thinks—that which compares, observes itself comparing—that which judges, reasons, desires, resolves, watches over its own judgments and reasonings, examines into the motives of its own desires, and tells why it resolves. Yet this, and more than this, is what man does when he ceases to contemplate the objects of sense, and directs his attention to the phenomena of his own mind. Not only does he perceive himself thinking, attending,

comparing, judging, desiring, willing—but he discovers that his thoughts, judgments, desires and volitions, are regulated by a system of laws, independent of himself, as complete and universal as any that he has recognised in the material world. That they follow one another by a law of succession, as uniform as the gradation by which animals rise, one above another, in the scale of being, and that they are associated together into different catenations, like the planetary systems, and held by a bond as simple and extensive as the principle of gravitation.

The benefits accruing to man from this study are incalculable. It is here that the bond of union between man and his species lies. From perceiving that he is uniformly affected by the same things in the same way—perceiving also, the same motives in himself, prompting to the same actions—he is led to infer the existence of the same motives, when he witnesses the same actions in others, and the same affections, when acted on by the same agencies. Hence he is able to calculate what will be the line of conduct of his fellow man in a given emergency; and on this basis lays the foundation of morals, of social rights, of civil law, and of all the branches of political philosophy.

From his own mind as a starting point, he sets forth afresh, and with the light it affords pursues a new path of inquiry, which indeed promises to lead him to results less brilliant and dazzling at first view, because they strike less obviously the senses, but which affords the highest scope for the exercise of his faculties, from the magnitude of the subjects he grapples with, and the manifold perplexities in which he finds them involved. He pries into the origin and nature of that medium by which he holds intercourse with his neighbor, interchanging thoughts and feelings—preserves and accumulates discoveries—exchanges products—treasures up the knowledge of the past and holds converse with the wise and great of all ages and all countries. He investigates his natural rights—civil, political and religious—the duties he owes to himself and society—the obligations that rest upon him, and form moral rules, and codes of laws for his guidance. In the fluctuations of trade, he discovers a regulating and controlling principle—limits the amount of production by the amount of consumption, and lastly,

finds a necessity for the existence of vice and misery, in the check it gives to a redundancy of population over the means of sustenance.

He analyzes the structure of states, and examines the proportions of the several members of which it is composed—cuts in pieces the body politic, as it were, with a dissecting knife, and examines the anatomy of its minutest parts. He finds that it has a circulating medium, like his own life-blood—that it is composed of different members, which, when properly balanced, sustain and support each other and the whole—nervous chords of union and concentration, which serve to transmit a vital influence to all its parts, and diffuse over the whole life and activity.

The light in which we have considered man, as he develops his physical and intellectual energies, under the benign influences of civilisation, is calculated to impress us with the most exalted ideas of his powers and capacities as a being and agent in the universe. So vast and comprehensive—so varied and multiplied—so far removed from the highest manifestations of power and intelligence in the rest of creation, do they seem, that we are almost constrained to regard them as infinite, and to ask—if this is the true conception of man—what forms that of the Deity? We are almost prompted to inquire, do not the works of art equal the works of nature? Has not the riches, beauty and grandeur of the earth more than doubled under man's administration? Nay! has not man transformed himself within the last six thousand years? Is he not a different being, a new animal, as much above himself originally, as he then was superior to the beast of the field? and has he not himself effected this transmutation of species?

But there is another side of the picture, which, though it is less flattering to human pride, it becomes us to contemplate with humility and reverence. The very ground which we have gone over, if it exhibits his strength, exhibits also his weakness. Every display of his power, displays also his meanness, as if intended to check him at the outset, from arrogance and boastful presumption. Every work of art, when contrasted with the works of nature—every scientific investigation, every relation he sustains to other animals, and to his fellow man—while it reveals to him how much he has received from the

hand of his Maker—warns him also that his gifts to him are limited. The stamp of imperfection rests on all his works. He imitates, but never equals the type set in nature. He surveys—but the sphere of his vision is bounded. He reasons—but never ascends to the fountain of all truth. He may make an artificial flower, but he can neither give it the living odor of the natural one, nor convert it into fruit. He may construct a telescope, with its achromatic lenses, and adjust them to focal distances—but he can place within it no cellulated vitreous humor—no crystalline lens, increasing in density as it approaches the centre, with a double convexity, turned without mechanical curves—no cornea, nor iris, contracting by the stimulus of light; and least of all, a nervous web to receive and transmit the impressions made upon it. The clarion and the bugle are easy things to him—but not so the larynx, and the organs associated with it in the formation of the human voice. He even tasks his ingenuity in vain to tell whether it is a wind or stringed instrument.

In chemistry, it is true, he finds himself able to turn the diamond into charcoal, but he had much rather turn the charcoal into the diamond. And though he prides himself on resolving matter into its ultimate atoms, he perceives that these ultimate atoms possess tempers and dispositions to which he is obliged to accommodate himself, or lose the advantage this knowledge gives him over them. The lightning, too, which he directs in its course, and feeds as it were in troughs, will not suffer itself to be approached, even by him, without much previous ceremony; it is always ready to assert the supremacy of its own laws over any which he desires to impose on it, and if, by ignorance or negligence, he fails in that respect and attention, in the presence of this mighty and invisible power which is its due, he often pays with his life the forfeit of his rashness and temerity.

In the midst of his researches, however extensive they may be on all sides, he discovers a termination, which rests not upon any natural boundaries of the field into which they are carried, but on the limitation of his faculties. He finds himself in a circle, with a circumference coinciding with that of his sphere of vision. Far as he can distinguish planets or stars, by the aid of the

most powerful telescope, the dim glimmerings of others, still more remote, disclose the mortifying truth, that to him it is not given to span the compass of the heavens.

With the microscope, he examines the internal organs of animals, whose length does not exceed the twenty-five thousandth part of an inch, yet how many animals, of infinitesimal proportions, may be supposed to exist between that dimension and mere space, of whose structure and functions he knows and can know nothing.

In like manner, when he endeavors to arrive at the hidden springs of the functional movements of animals and vegetables, he finds his progress arrested by an impassible barrier. He cannot see how, from a number of different substances taken into the stomach, the digestive apparatus can extract a simple and homogeneous fluid like chyle. He can trace the blood vessels and nerves passing into the substance of the liver, and the veins and gall ducts coming out—but why black blood should always pass through one set, and bile through the other, he may become weary with guessing. Still more is he at a loss when he undertakes to ascend to the sources of thought. That the brain is the organ chiefly devoted to the manifestations of thought, he has as much reason to believe, as that the liver is the organ of the biliary secretion. He may go further than this—he may acquire some idea of the motions going on in the brain, in the process of thinking—he may form a conception of a vibration of nervous chords, or of an undulatory motion in the nervous fluid—but he can never effect the transition between these motions or vibrations, and the sensation immediately derived from them, and which has its seat in consciousness. He may be able to know them both, because he has an avenue capable of leading him to the knowledge of each, but he can never link the two together, and discern the relation between one and the other, for that is beyond the scope of his faculties; and whenever he attempts it, he arrives at the mortifying conclusion that his toil is idle and vain.

Human weakness and imperfection are illustrated still more forcibly in our social and domestic relations. Whatever object man pursues, it is too often the case that he mistakes the pursuit for that which he pursues. If he endeavors to attain wealth as a means of increasing his

enjoyments, it is seldom that he pursues that object with singleness and perseverance. In almost every instance he reverses the maxim with which he set out, and places his chief enjoyment in the pursuit of wealth itself, instead of considering it as a means to an end. In like manner, in providing for his wants, he seldom stops at the conveniences of life, but abuses the bounties of Providence by luxury, and indulgence in sensual gratifications. He commences, perhaps, with the proverb in his mouth, that "we must eat and drink in order to live," and terminates with the proverb, "we must live in order to eat and drink."

In his political relations, notwithstanding his reverence for law, and his sacred regard for liberty—in spite of the knowledge of his own rights and duties to others, and the checks and balances and props, which he interposes between the different branches of government—he is always vibrating between the wildness and turbulence of anarchy on the one hand, and the stagnation of despotism on the other. He theorizes well concerning the advantages of a distribution of labor—yet he never exhibits in the constitution of the societies he forms, that regularity in the distribution of offices, that exact adaptation of parts to the whole and to each other, which is displayed by that insect, whose little communities furnish him with the models on which he builds. He reasons ably and conclusively on the increase of power by concentration and combination—yet when he undertakes to reduce his reasoning to practice, the clashing of opposing interests and the commotions of party strife whisper to him, that even now he may go to the ant and learn to be wise.

Domestic happiness he portrays admirably in novels and romances—but when he undertakes to illustrate it by living examples, he borrows his terms of comparison from the dove cote and sparrow's nest, instead of his own fire-side.

These reflections are indeed humiliating to the pride of man, for while they serve to show that he is an imitator, it shows also he cannot equal what he endeavors to imitate. His consolation, however, is derived from the fact that he is capable of imitating, not one thing, or a few things, but many ; I might say, perhaps, all things ! and considering the rapid improvement going on in his

condition, though he may never expect to attain to perfection, he may approach indefinitely near to it. The grand characteristic of instinct is constancy. That of intelligence is variety and improvement. Instinct is the same in every animal of the species, continues the same at death as it was at birth, and through successive generations. Intelligence, on the contrary, varies with the individual, varies with the period of life, and varies with the epoch of time. Instinct never expands—intelligence always. Wherever utility is coupled with truth, there the mind of man is found capable of grasping truth. To him it is given to know whatever is useful for him to know. His knowledge is limited by his ability to profit by it, and by that only. Hence it is only when he pushes reason to the investigation of truths that bear no relation to his nature nor wants, that it returns to him baffled and crest-fallen. He is allowed to know what is useful for him to know, but nothing further.

He was placed on the earth, not to prove, as he has undertaken to do, that there was no external world, or that matter was nothing but mathematical points, possessed of the powers of attraction and repulsion, or that he himself was nothing but a bundle of ideas. But the earth was given him for a possession and a habitation, with every green and every living thing. The different branches of science are the means which enable him to bring all things under his dominion; and in proportion as he cultivates them, he finds his power and enjoyments increased. They furnish him with the means of conveyance, and conduct him to the utmost boundaries of the earth. They enable him to penetrate its depths, and bring forth from thence its mineral treasures, and teach him how to apply them to his use. They introduce to him every green and living thing, and show him the relation he sustains towards them—how far they throw light on the functions carried on in his own body, and to what extent they promote health and remove disease, or in any way may become subservient to his purposes. They place before him the chart of history and the chart of geography, and exhibit in one view himself in every grade of civilisation. The most distant times and the most distant countries are placed side by side, and all the intermediate phases between barbarism and refinement

of his species, are drawn in parallel lines on the map, to illustrate, as if by a double lesson, his nature, and point out, with unerring certainty, the path of improvement that still lies before him.

While he confines himself within the limits of the circle which the hand of the Almighty has traced for him, he finds that every voyage of discovery he attempts, whether on the mighty ocean, or in the meanderings of science, returns him richly freighted with commodities, whose value increases in proportion to his wants. It is only when he ventures beyond this, that himself and his hopes are shipwrecked or tossed on the dark and unfathomable abyss, without helm to guide or compass to direct his course. The history of the past, through all the revolutions in human affairs, is but an illustration of this truth. It shows that where man has risen, he has elevated himself by the developement and exercise of his faculties within this sphere. That where he has fallen, he has sunk from the elation of pride, or the enervation of luxury. The stimulus of adversity developes his energies, and loses not its momentum until it carries him upward to the highest pinnacle of power. As surely does the overweening self-confidence, and effeminacy that always go hand in hand as the twin offspring of success and prosperity, precipitate him from his lofty elevation into the lowest depths of ignominy and disgrace. The story of republics is told in the fate of empires. Their greatness springs from the same virtues—their fall from the same vices. Patriotism and loyalty are one and the same, whether they are devoted to the sovereign king or the sovereign people. So the cup of flattery is a poisoned chalice, whether administered by the hand of the polished and wily courtier, or by that of the rougher but no less crafty demagogue. Compare the history of the great hero of antiquity with the modern Alexander. Their characters and fortunes embody the two leading conceptions of the rise and fall of nations. The former extending one hand of his power over the republics of Greece, now become the sinks of vice and corruption, and a prey to artful demagogues and to intestinal commotions, which were but the effervescence of their putrescency; and the other over the weak and effeminate monarchies of Asia, wept because he had no more worlds to conquer, sought

in the most degrading sensuality that relief to his restless spirit which the pursuit of war and conquest no longer afforded him, and died beneath the level of the meanest animal in all his dominions—the greatest of men—the lowest of brutes. The ambition of Napoleon did not reach this elevation. He was destroyed by pin thrusts, to use his own language, while yet there were worlds to conquer. He fell not by luxury, but by overleaping in his vaulting ambition the limits prescribed to him by nature. Not content with conquering republican France and giving away the richest diadems of continental Europe, his indomitable spirit led him to grapple with the Polar Bear of Russia in his den,—and the empire of France perished in the chilling embrace.

Now how much might have been accomplished by these men—how much they might have deserved the praises and gratitude, as they now do the censure of posterity! Had they considered power as the means of doing good instead of an end to be obtained, they might have been respectively the regenerators as well as the conquerors of the ancient and the modern world. As it is, they have been surpassed in every thing that constitutes true glory by many of the humble subjects of both their empires. Who would exchange the laurels that science has wreathed around the brow of her Cuvier and her Aristotle, for the tarnished lustre of those with which war and victory has encircled the heads of their masters, Napoleon and Alexander. The histories of these individuals are dark spots on the human character. But dark as they are, they serve to represent in bold relief the nature of man as it displays itself in the free and unlicensed possession of power. They concentrate in the individual, what is true of the species. As they rose by energy and perseverance, so rise commonwealths. As they fell by overweening self-confidence and the enervation of luxury, so fall commonwealths—witness the republics of Greece and Rome and those of modern Italy.

But if a review of the past exhibits man's pride of reason and pride of power in so unenviable a light, it exhibits also his redeeming qualities. The revolutions on the face of human affairs, like the revolutions on the face of the globe, show him constantly improving by the lessons of dear-bought experience which they furnish. Each

successive state of civilisation is more complete than that which preceded it. From the rubbish of fallen states and empires he gathers materials which, added to his original stock, help to raise and perfect a more stately and finished edifice than that which so lately crumbled into dust. He has passed through his age of brass, his golden age, his iron age, and his dark age. And he now appears on the theatre of modern civilisation, with a portion of the iron and brass to consolidate the edifice he is now erecting, and a portion of the gold to enrich and adorn it, and has brought light out of darkness to enlighten it. Every truth that is revealed becomes a mighty engine which he wields to extend his sway and secure himself in the possession of empire. It is not an inanimate, lifeless existence, but a germ gifted with the powers of expansion and reproduction, which, if rightly nurtured, is capable, both singly and blending with other truths, of bringing forth fruit after its kind. He has it in his power to imitate all that is worthy of imitation in the old world, with the same original genius to construct anew. He has in his possession all that is valuable of the knowledge of the ancients, and in addition, all that the art of printing, the art of navigation, the discoveries in physics and morals, and in political philosophy, place at his disposal. He is moreover beginning to discover that national character, like national wealth, is but the sum total of individual character; national virtue, but the sum total of individual virtue; national vice and crime, but the sum total of individual vice and crime. And that the individual is a sharer in the weal or woe, the honor or dishonor, and in a greater or less degree is accountable for the sins of the nation. Coming home to the individual, he recognises a close relation between the moral and physical man, and places the foundation of morals in a complete system of physical, as well as moral training. He acknowledges in himself a triple life—an organic, an intellectual and a moral being; each regulated by laws which harmonize with, and re-act upon each other; and that their culture and developement in accordance with this harmonious and re-active unison is the end that nature had in view in constituting him as he is and placing him where he is.

Under these happy auspices what may we not reason-

ably expect him to accomplish before the scene changes which he is now acting? Will he need another revolution to humble his pride, to punish him for his crimes, and to warn him of his errors?—another eruption of the Goths and Vandals, to mingle races—to purify his blood from the gross and polluted humors engendered by luxury and sensuality, and restore his physical energies? May we not hope rather, that by founding education on the three systems of laws which constitute the trinity of his nature—developing himself more and more in the unison and harmony of each, through successive generations—moulding himself beneath the noon-day brightness of the sun of science—refining and perfecting himself by the mellowing rays of light, transmitted down to him through the medium of his past errors; he will neither cease nor intermit his labors, until the moral attributes of the Deity are mirrored forth from the moral character of man, in colors as much more resplendent than those which reflect it from all physical things, as mind transcends matter.